



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Schultz

: Art Unit: 3672

Serial No. 10/036,105

: Examiner: Jones, Robert D.

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For: System and Method for Signalling Downhole Conditions to Surface

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INFORMATION DISCLOSURE STATEMENT

APR 07 2003

Honorable Commissioner of Patents and Trademarks

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GROUP 3600

Sir:

The accompanying form PTO- 1449 lists one or more documents which may be considered material to the examination of this application. A copy of each document is provided, if available.

Applicant reserves the right to establish the patentability of the claimed invention over any of the listed documents should they be applied thereagainst as references, and/or to prove that some of these documents may not be prior art, may not be within an analogous field of art, and/or may not be enabling for the teachings they purport to offer.

This statement should not be construed as a representation that an exhaustive search has been made, nor that more material information does not exist.

The Examiner is specifically requested to conduct an independent and thorough review of the documents, and to form his own opinions as to the significance of those documents to patentability of the claimed inventions, regardless of any of the foregoing statements concerning the significance of the references. The foregoing statements are made in good faith, and in compliance with the duty of disclosure; but they cannot substitute for the Examiner's specialized expertise, nor are they intended to derogate from the Examiner's official duty to assess patentability.

It is also respectfully noted that the submission of this material is not intended to displace the Examiner's professional ability and duty to search. Indeed, the Examiner is specifically requested not to rely on the materials submitted herewith, but to conduct a full and independent search.

It is respectfully requested that the Examiner initial and return a copy of the enclosed PTO-1449, to indicate in the file of this patent application that the documents have been considered.

Respectfully submitted,



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March 26, 2003

ANALYSIS OF US PATENTS RELATING TO ROCK BIT FAILURE DETECTION

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#	US Class	Patent Number	Date of Patent	Title of Patent	Inventors	Assignee	Abstract
	255-61	2,560,328	July 10, 1951	Dull bit indicator	W. Bielstein	Standard Oil	The flapper closes the duct when the blades of drill bit are worn, and the pressure of the drilling fluid increases
2	255-61	2,582,312	Jan. 15, 1952	Wear indicati - ng device for drill bits	D.L. Del' Homme	Reed	Drill bit with the wear tube and moving valve member, which opens outlets and drops the drilling fluid pressure
3	175-39	3,011,566	Dec. 5, 1961	Bearing wear indication for a roller bit	J.W. Graham	Jersey Product.	The capsule with the tracer material in the bearing of a roller bit
4	175-39	3,058,532	Oct 16, 1962	Drill bit condi- tion indicator and signaling system	R.L. Alder	Dresser	Electric, electromagnetic, oscillatory or radioactive signal about the wear of the cones
5.	175-39	3,062,302	Nov 6, 1962	Indicator device for bearing failures in drill bits	F.J. Toth et al	Shell	A temperature-sensing and heat transmitting system with explosive charge or a fusible plug, which changes the fluid pressure
6	175-39	3,363,702	Jan. 16, 1968	Rock bit dull- ness indicator	W. Bielstein	Esso	A wear probe engages heel teeth of cones and



							provides a drop in mud pressure
7	175-39	3,578,092	May 11, 1971	Drilling tools	H.J. Tesch et al.	Farbwerk	A drilling tool has a closed cavity, which contains the gas krypton
8	73-151 175-39	3,581,564	June 1, 1971	Method for detecting roller bit bearing failure	F.S. Young	Esso	Rotary torque and drilling rate are measured and its ratio is calculated. A sharp increase of this ratio indicates bearing failure
9	116-114 175-39	3,678,883	July 25, 1972	Worn bearing indicator	J.F. Fisher	Smith	An insert in the bearing of cones jams or locks the dull bearing and there is an increase in torque, or a breakable insert indicates the bearing wear by radio- active or dye material
10	73-151 175-39	3,703,096	Nov 21, 1972	Method of determining downhole occurrences in well drilling using rotary torque	A.L. Vitter et al.	Chevron	Measurement of the rotary torque oscillations for the indicating bit damage

				oscillation measurements			
11	73-104	3,714,822	Feb.6, 1973	Process for measuring wear on a drilling tool	J.Lutz	Petroles d Aquitaine	A process comprises the registration of vibrations produced by rock bit
12	83-62 175-39	3,728,919	Apr24,1973	Broken tool detector	W.B.Scott	Whitney	Pneumatic circuit opens a passageway for air, the pressure changes and produces an electric signal to indicate breakage of the tool
13	73-151 175-39	3,774,445	Nov.27, 1973	Method and apparatus for monitoring the wear on a rotary drill bit	H.A.Rundell et al.	Texaco	The method includes measuring the revolutions of the drill string and the weight on the bit, as a measure of bit wear
14	73-151 175-39	3,782,190	Jan.1,1974	Method and apparatus for rotary drill testing	R.W.Pittman	Texaco	Measuring the torque and the weight on the bit, dividing the torque by the weight to indicate incipient roller cone bearing failure when the ratio increases non linearly
15	250-303	3,818,227	Jun.18,1974	Radioactive tracer system to indicate drill bit wear or failure	B.A.Fries	Chevron	Utilizing krypton 85 in clathrate form, in the form of water-soluble kryptonates, or dissolved in grease

17	252-11 175-39	3,865,736	Feb 11, 1975	Radioactive grease containing krypton 85	B.A.Fries	Chevron	A radioactive tracer system for indicating drill bit wear utilizing krypton dissolved or dispersed in a grease. It is a variant of the patent #3,818,227
18	175-39	3,913,686	Oct 21, 1975	Method and apparatus for preventing and detecting rotary drill bit failure	C.D.Manson	Halliburton.	For the drilling of cement inside the casing a drillable core is placed below bottom cementing plug for engaging the roller cutters and excepting its jamming
19	175-39	4,030,558	Jun. 21, 1977	Wear determination of drilling bits	H.R.Morris	-	The method comprises the attraction by the magnet the ferrous cutting from the bit in flowing drilling fluid, examining them under a microscope for appreciation of drilling bit wear
20	175-107 175-39	4,114,704	Sep 19, 1978	Down hole well drilling	W.G.Maurer et al.	Maurer Engineer.	A turbo drill with fluid lubricant surrounding the

				tool with reversible thrust bearings			bearings and indication of loss of lubricant or wear of thrust bearings by change the mud pressure
21	73-151 175-39	4,346,591	Aug. 31, 1982	Sensing impending sealed bearing and gage failure	R.F. Evans	-	Use of electrical conduction elements for sense the presence of the aqueous fluid inside of bearing. A signal is transmitted to the surface by mud pulse telemetry
22	175-39	4,436,164	Mar 13, 1984	Lubrication failure detection system	L.L. Garner	Globe Oil Tools	Drill bit has a lubrication reservoir with flexible membrane that contacts a piston when the lubricant is depleted, and the pressure of the drilling fluid decreases
23	29-434	4,441,244	Apr 10, 1984	Sealed bearing rotary rock bit assembly	G.A. Cason	Dresser	Detecting water in the bearings and lubricant reservoir system of rock bit while manufacturing of one
24	175-40	4,548,280	Oct 22, 1985	Drill bit having a failure indicator	J.E. Daly et al.	Reed	If the lubricant system loses a grease, the piston or the spherical valve decreases or increases the pressure of the drilling fluid

25	367-82 175-40	4,562,559	Dec 31, 1985	Borehole acoustic tele- metry system with phase shifted signal	H.E. Sharp et al.	Sperry Sun	An acoustic signal is placed on the pipe string and transmits the data from the bottom with a minimum level of attenuation
26	175-40	4,610,313	Sep. 9, 1986	Drill bit having a failure indicator	J.E. Daly et al.	Reed	It is a variant of the patent # 4,548,280

29	73-151 175-39	4,685,329	Aug. 11, 1987	Assessment of drilling conditions	T.M. Burgess	Schlum- berger	A method of assessing drilling conditions and the bit teeth wear includes gathering measurements
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						of torque, WOB, ROP, RPM and its graphical representation
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31	175-39	4,730,681	Mar 15, 1988	Rock bit cone lock and method	R.D.Estes	Rock Bit Industries	There is the lockup groove in the ball race of the journal pin for locking the cone after the bushing wear and for increasing the rotary table torque
32	73-151 175-39	4,773,263	Sep 27, 1988	Method of analyzing vibrations from a drilling bit in a borehole	M.Lesage et al.	Schlumberger	Using of vibrations for the information about the wear of drilling bit. For example, abrupt changes in frequency distribution curves indicate the broken teeth or stuck cones
33	175-39	4,785,894	Nov. 22, 1988	Apparatus for detecting drill	A.P.Davis et al.	Exxon	The bit wear indicator includes a sensor to detect

				bit wear			the bearing or gauge wear, a tensioned wire extending between the wear sensor and the flow resistance altering valve that increases the pressure of the drilling fluid
34	175-39	4,785,895	Nov.22 1988	Drill bit with wear indicating feature	A.P.Davis et al.	Exxon	It is a variant of the patent # 4,785,894
35	407-113 175-39	4,818,153	Apr.4,1989	Cutting insert having means for detecting wear	I.H.Strandell et al.	Santrade	Cutting insert has a sub-stratum comprising a photon-emitting material, and the intensity of the photons shows the wear
36	73-151 175-39	4,852,399	Aug.1,1989	Method for determining drilling conditions while drilling	I.G.Falconer	Anadrill	Utilizing surface and sub-surface sensors with an acoustic data transmission system to determine ROP and torque for separate the bit wear from changes in rock strength
37	73-151 175-39	4,876,886	Oct31,1989	Method for detecting drilling events from measurement while drilling sensors	M.Bible et al	Anadrill	It is a variant of the patent # 4,852,399

39	73-151 175-39	4, 926686	May 22, 1990	Method for determining the wear of the cutting means of a tool dur- ing drilling ro- cky formation	H.Fay	IFP	Method includes a measu- rement of the WOB and the torque, then the degree of the cutting wear is calculated according to an equation
40	175-39	4,926,950	May 22, 1990	Method for monitoring the wear of a rotary type drill bit	D.H.Zijsling	Shell	Cutting elements of PDC bit with varying thickness of the front layer
41	73-151 175-39	4,928,521	May 29, 1990	Method for determining drill bit wear	S.Jardine	Schlum- berger	Method by which the drill bit vibrations and the rate of cones rotation are detected for deriving the state of the drill bit wear

				control by vibration analysis			its failure
43	175-228	5,183,123	Feb.2, 1993	Indicating means for a rock bit lubricating system	K.M. White	Western Rock Bit Company	A lubricant reservoir of the rock bit has a valve controlling the fluid flow along the passage means intersecting the lubricant reservoir and changing the fluid pressure if the grease depletes
44	73-151 175-39	5,216,917	Jun.8, 1993	Method of determining the drilling conditions associated with the drilling of a formation with a drag bit	E.Detournay	Schlumberger	Method comprises measuring WOB, bit torque, angular rotation speed of the bit, ROP and calculating specific energy and drilling strength for the detection of lithology and wear of the bit
45	175-39	5,305,836	Apr26, 1994	System and method for controlling drill bit usage and well plan	P.Holbrook et al.	Baroid	A method comprises the drilling a portion of well, measuring drilling data, converting these data into electrical signals, inputting its to a computer and continuing use of the bit or retiring the bit in accord with wear calculation signal

46	175-1 175-40	5,372,207	Dec13,1994	Seismic prospecting method and device using a drill bit working in a well	C.Naville et al.	IFP	A method consists in the control of seismic signals from a drill bit in order to characterize the rock crossed and to diagnose the time when the drill bit is worn
47	73-151 175-39	5,415,030	May 16, 1995	Method for evaluating formations and bit conditions	P.N.Jogi et al.	Hughes	A method comprises the measurement WOB, bit torque, RPM, ROP and evaluating by calculations the formations and bit condition while drilling
48	175-40 175-39	5,794,720	Aug. 18, 1998	Method of assaying downhole occurrences and conditions	L.M.Smith et al.	Dresser	A method comprises the drilling an interval, generating a plurality of electrical incremental actual force and distance signals producing a total work done by the bit and rating the bit wear

US PATENTS RELATING TO BEARING FAILURE INDICATORS IN VARIOUS DOMAINS OF INDUSTRY

#	US Class	Patent Number	Date of Patent	Title of Patent	Inventors	Assignee	Abstract
1	116-114	3,853,087	Dec. 10, 1974	Bearing failure indicator	D.B.Aldag	Panhandle Eastern Pipe Line Co.	It is an indicator of the failure of the bearings supporting a rotation shaft. A magnet is positioned adjacent a shaft and supported for movement in the direction the shaft moves when the bearings fail. A switch is actuated by such movement to indicate that the bearing has failed
2	308-1A	4,063,786	Dec. 20, 1977	Self-lubricating auxiliary bearing with a main bearing failure indicator	M.E.Rall	Westinghouse Electric Corporation	An auxiliary bearing structure having a self-lubricating sleeve which is engaged by a shaft mounted runner which also actuates a main bearing failure indicator
3	73-344	4,074,575	Feb. 21, 1978	Temperature and failure indicating probe for a bearing	M.O.Bergman et al.	The Trane Co.	A thermistor is disposed within a tubular, electrically conductive, enclosure which one is surrounded by an electrically insulating sleeve for mounting within a bearing. A resistance sensor detects an excess temperature or bearing wear
4	116-67R	4,148,271	Apr. 10, 1979	Incipient bearing failure indicator	P.M.Majernik	General Motors	If the cage of the bearing fails, the rollers bunch up forming a gap which allows the probe to drop into the gap to unlatch the hammer which swings against the bell to cause a signal of an audible indication of imminent bearing failure

5	340-682	4,379,291	Apr.5, 1983	Bearing failure indicator for rotating electric machines	L.E.Hubbard et al.	Texas Eastern Scientific Research	In an electrical machine, conductive strips insulated from the stator are circularly spaced into the rotor-stator clearance space. Upon excessive lateral rotor movement, it contacts a strip and de-energizes the motor
6	308-227	4,425,010	Jan. 10, 1984	Fail safe dynamo -electric machine bearing	R.A.Bryant et al.	Reliance Electric Co.	A vertical shaft machine has two bearings at one end of the machine. If the first bearing should fail, then the shaft will drop slightly, due to gravity and applied external forces, and the second bearing will become enabled, rotatably journaling the shaft
7	364-507	4,493,042	Jan. 8, 1985	Bearing failure judging apparatus	I.Shima et al.	Mitsubishi	A detected signal wave detected from a bearing is lead to a time domain extracting means and a frequency domain extracting means in order to extract features of the detected signal wave in the time domain and features thereof in the frequency domain
8	246-169	4,659,043	Apr.21, 1987	Railroad hot box detector	C.A.Gallagher	Servo Corporation of America	A hot box detector system utilizes an infra-red scanner to scan the bearings of railroad cars passing along a section of track with means for determining if the surfaces being scanned dissipate heat from bearing to bearing
9	340-683	4,665,393	May12, 1987	Vibration monitoring system and apparatus	P.L.Wilder et al.	-	The probe assembly is supported on the fixed housing of the rotating shaft for contact therewith upon occurrence

							of excessive vibration. An electronic circuit is provided which detects and registers the excessive vibration on the monitor through a visual and audible alarm
10	73-660	4,790,190	Dec.13, 1988	On-line acoustic detection of bearing defects	J.E.Bambara et al.	Servo Corporation of America	It is an apparatus for the detection of acoustic impact frequencies, characteristic of bearing assembly failure during operation, which modulate an acoustic carrier frequency band
11	340-682	4,812,826	Mar.14, 1989	Thermal sensor for detection of railroad bearing failures	W.M.Kaufman et al.	Carnegie-Mellon University	A thermal sensor composed of a standard bolt which has been modified to embody a temperature sensing element and placed into a bearing assembly of a train. This element contains a heat-sensitive wax that at a preset temperature expands causing the motion of a piston which exposes projections
12	73-651	5,001,993	Mar.26, 1991	Micromechanical vibration sensor	J.H.Brand	Secretary of the Army	The miniature bearing failure sensor includes a micromachined mechanical resonator with a conductive cantilevered beam mounted on a conventional insulating substrate to form a microchip
13	73-118.1	5,072,611	Dec.17, 1991	Apparatus and method for testing wheels, bearing and lubricants	J.M.Budd et al.	The B.F. Goodrich Co.	A test apparatus comprises a hub and wheel web rotatably mounted on a bearing set in the wheel hub and mounted on a non-rotatable axle mechanism. An acoustic sensing means enable determination of the onset of bearing failure

14	340-682	5,140,311	Aug. 18, 1992	Pump shut-down system	F. Cooc	Chevron	A pump shut-down system prevents damage to the pump from bearing failure and has a metal bar, voltage source and automatic shut-down relay
15	384-551	5,249,871	Oct. 5, 1993	High force ball bearing	R.R. LaTorte	Raytheon Co.	A ball bearing assembly with a spacer to prevent bearing failures. The spacer has two rings which are coupled to the outer and inner rings of the bearing. The spacer allows relative rotation of the ball bearing rings but prevents relative translation of the rings beyond a point which will damage the bearing
16	310-90	5,602,437	Feb. 11, 1997	Bearing failure detector for electric generator	M. Shahamat et al.	Lucas Aerospace Power Equipment	A bearing failure detector includes a disk which is connected to a resistor which is monitored by a control circuit. When the clearance of the bearings enlarges by predetermined amount, the resistance changes to provide an indication that the bearing need replacement
17	350-584	5,633,628	May 27, 1997	Wheelset monitoring system	J.M. Denny	General Railway Signal	A temperature sensor extends into the wheel assembly in order to obtain accurate readings of high temperatures. Upon determination of a warning condition, an electronic circuit transmits a warning signal to a wayside station or train crew
18	73-593	5,677,488	Oct. 14, 1997	Piezoelectric film transducer system for bearings	R. Monahan	NTN	A bearing monitoring system uses a piezoelectric film transducer for detecting and predicting bearing failure

19	340-682	5,691,707	Nov. 25, 1997	Sensory fitting for monitoring bearing performance	C.C.Smith et al.	Security Operating Systems	A device for monitoring bearing performance in apparatus having an aperture sized and configured to receive the grease fitting. The device includes the temperature or vibration sensing components, or both, to enable detection of impending bearing failure
20	384-448	5,865,543	Feb. 2, 1999	Bearing failure detection apparatus	J.K.MacLean	-	A warning device is mounted on the stationary axle inside the wheel housing adjacent the brake mounting assembly to remain stationary. The device includes a probe which protrudes outwardly so as to have a sensing end extend until it is a predetermined distance from the rotating brake drum

US PATENTS RELATING TO THE DRILL STRING VIBRATIONS

#	US Class	Patent Number	Date of Patent	Title of Patent	Inventors	Assignee	Abstract
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2	340-18 175-40	4,001,773	Jan.4, 1977	Acoustic telemetry system for oil wells utilizing self generated noise	A.E.Lamel et al.	American Petrosence Corporation	It is a variant of the patent #3,906,434
3	340-18 175-40	4,040,003	Aug.2, 1977	Downhole seismic source	P.A.Beynet et al.	Standard Oil	A downhole seismic source is used for the determination of the location of the bottom of a bore hole

5	367-81	4,903,245	Feb.20,1990	Downhole vibration monitoring of a drill string	D.A.Close et al.	Exploration Logging	An apparatus for monitoring vibration of a bottom hole assembly includes an accelerometer mounted in the BHA to generate data in the form of electrical signals, which can be taken to prevent damage to downhole equipment
6	324-162 175-40	4,958,125	Sep.18,1990	Method and apparatus for detecting	S.Jardine et al.	Anadrill	The centripetal acceleration of the drill string is measured at two opposite ends of a

			etermining characteristics of the movement of a rotating drill string including rotation speed and lateral shocks			drill string diameter so as to obtain two signals; these signals are combined and the instantaneous rotation speed or the lateral shocks are derived
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8	367-25	5,159,577	Oct.27,1992	Technique for reducing whirling of a drill string	J.R.Twist	Baroid	A sensor signals are generated at time intervals of less than half the period of rotation of the drill collar, and the frequency component attributable to the eccentric rotation of the drill collar is determined
9	73-151 175-40	5,226,332	Jul.13, 1993	Vibration monitoring system for drillstring	M. Wassell	Hughes	A system includes four spaced accelerometers which measure and differentiate between lateral, longitudinal and torsional drillstring vibrations
10	73-151	5,321,981	Jun.21,1994	Method for analysis of drill string vibration using torsionally induced frequency modulation	J.D.Macpherson	Hughes	Torsional oscillations of the drillstring will lead to frequency modulation of the signal from a vibratory source as the bit and are used to optimize drilling and drillstring performance